(12) UK Patent Application (19) GB (11) 2 226 092 (13) A

(43) Date of A publication 20.06.1990

(21) Application No 8925424.7

(22) Date of filing 10.11.1989

(30) Priority data
(31) 8826293 (32) 10.11.1988 (33) GB

(71) Applicant
Ronald Stephen Coley
6 Scraptoft Lane, Leicester, LE5 1HU, United Kingdom

(72) Inventor
Ronald Stephen Coley

(74) Agent and/or Address for Service
Forrester Ketley & Co
Chamberlain House, Paradise Place, Birmingham
B3 3HP, United Kingdom

(51) INT CL[5]
F16H 61/16

(52) UK CL (Edition K)
F2D DB21 DB22 DCC D130 D132 D139 D151 D190 D241 D250
U1S S1875

(56) Documents cited
GB 2055999 A GB 2037911 A GB 1556871 A
GB 1514972 A EP 0246353 A1

(58) Field of search
UK CL (Edition J) F2D DCC
INT CL[4] F16H 57/06
Online databases: WPI, CLAIMS

(54) Vehicle control system inhibiting ratio or direction change if engine speed or vehicle speed is too high

(57) A vehicle control system comprises a plurality of speed sensors (SS1, SS2, SS3, SS4, operative to detect engine speed and vehicle speed at predetermined level, to carry out switching operations to prevent or to allow gear change to be effected, in accordance with the sensed parameters. The invention has been devised particularly to prevent a driver from effecting a gear change operation in the event of a high engine speed, and to prevent (in the case of a fork lift truck) shifting of the gear level directly between forward and reverse position whilst the vehicle speed and/or engine speed are greater than predetermined levels.

There are preferably multiple sensors to detect engine speed exceeding successive different levels.

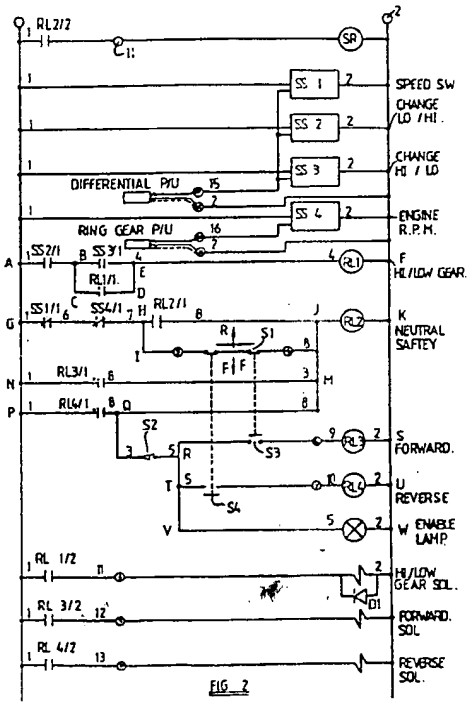

FIG 2

GB 2 226 092 A

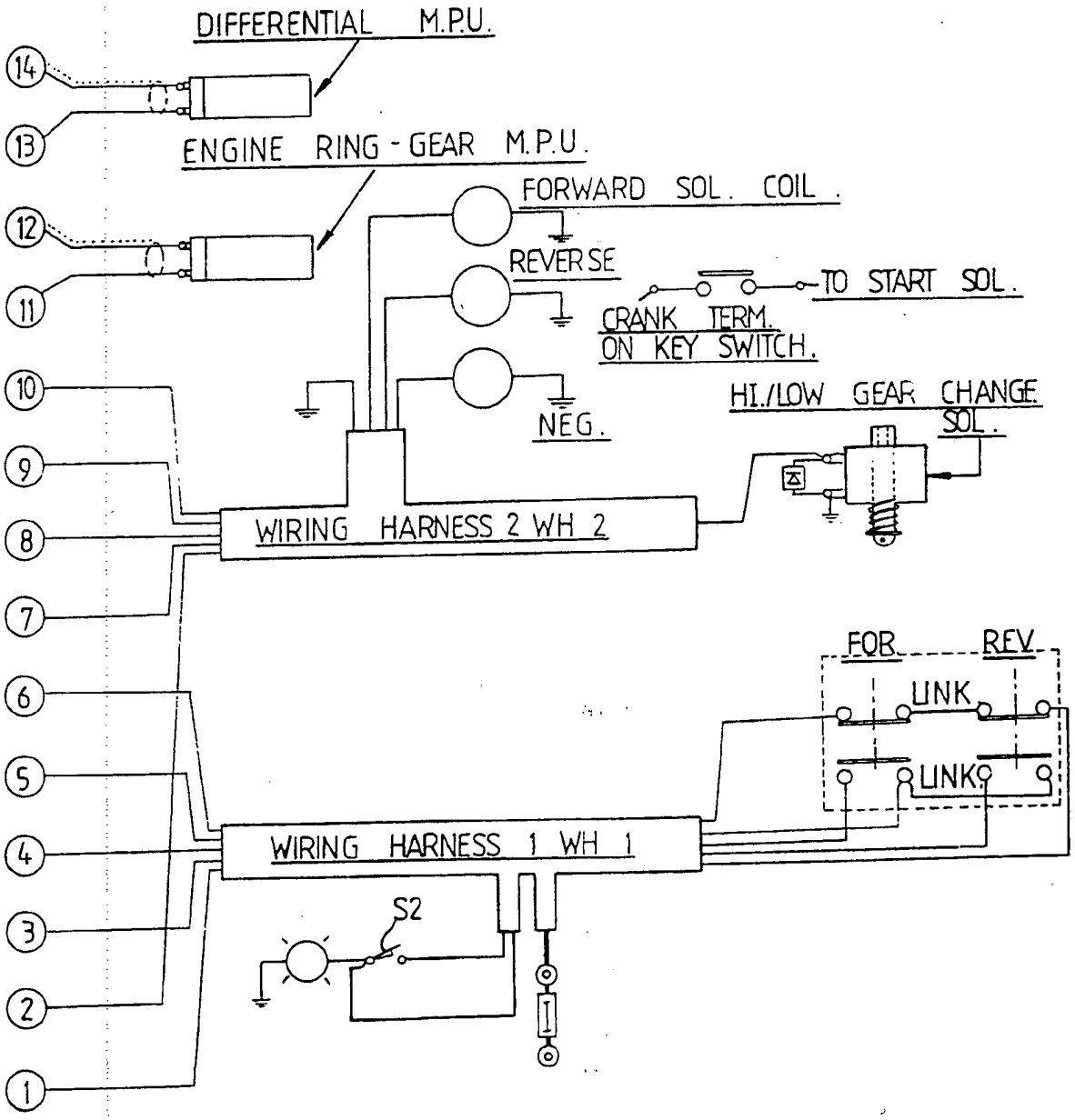
DIFFERENTIAL M.P.U.
14
13
ENGINE RING-GEAR M.P.U.
12
11
FORWARD SOL. COIL.
REVERSE
TO START SOL.
CRANK TERM.
ON KEY SWITCH.
NEG.
HI./LOW GEAR CHANGE SOL.
10
9
8
7
WIRING HARNESS 2 WH 2
FOR
REV.
LINK
LINK
6
5
4
3
2
1
WIRING HARNESS 1 WH 1
S2

FIG. 1.

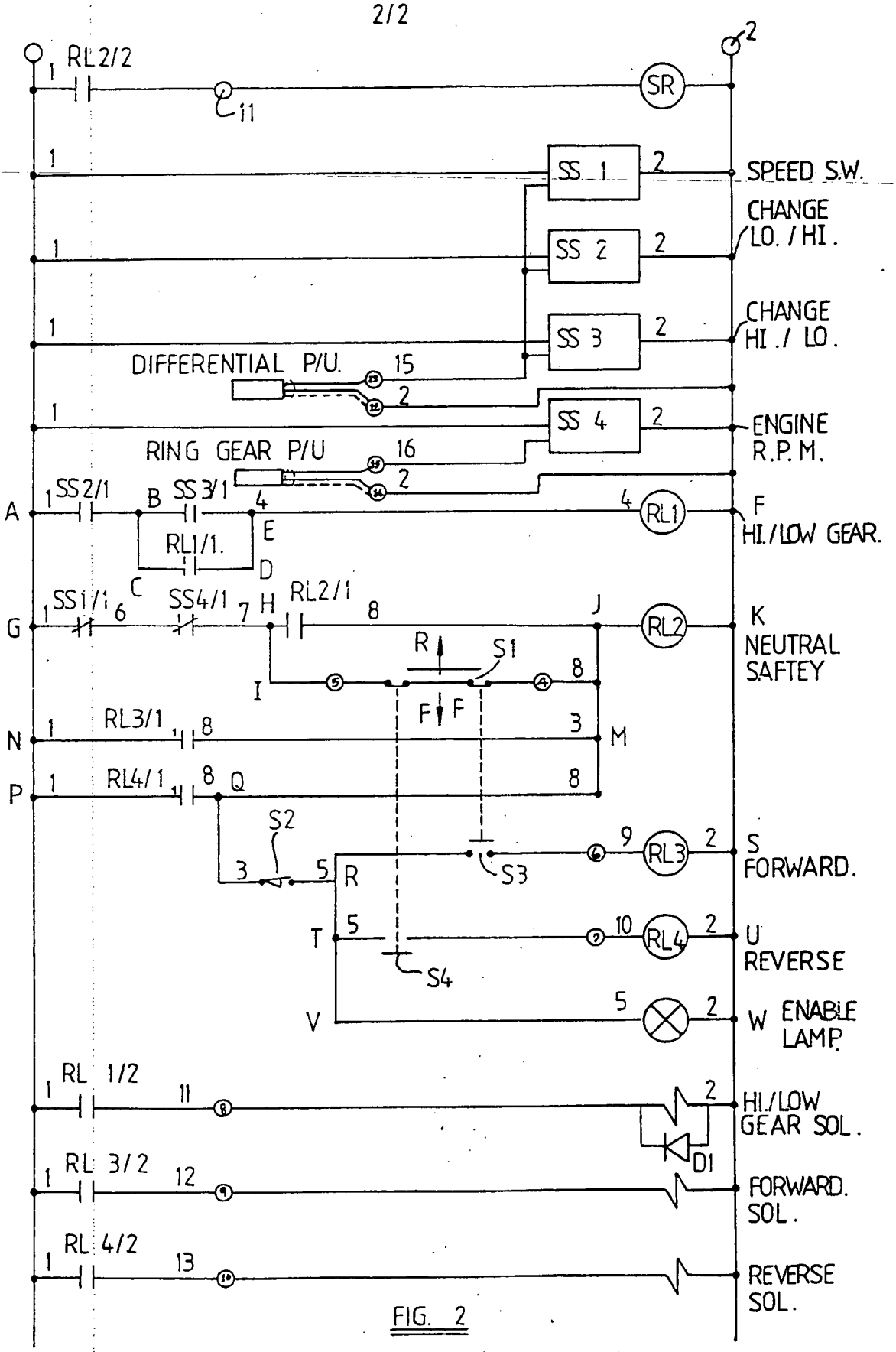
RL2/2
SR
SS 1
SPEED S.W.
SS 2
CHANGE LO. / HI.
SS 3
CHANGE HI. / LO.
DIFFERENTIAL P/U.
SS 4
ENGINE R.P.M.
RING GEAR P/U
SS2/1
SS3/1
RL1
F HI./LOW GEAR.
RL1/1.
SS1/1
SS4/1
RL2/1
RL2
K NEUTRAL SAFTEY
S1
RL3/1
RL4/1
S2
S3
RL3
S FORWARD.
RL4
U REVERSE
W ENABLE LAMP.
RL 1/2
HI./LOW GEAR SOL.
D1
RL 3/2
FORWARD. SOL.
RL 4/2
REVERSE SOL.

FIG. 2

PATENTS ACT 1977

WL/BMC/A 5638 GB

Title: "Vehicle control system"

Description of Invention

This invention is concerned with improvements relating to vehicle control systems, specifically control systems adapted to prevent a vehicle (such as a truck) being driven outside predetermined parameters.

The invention has been designed primarily for use with vehicles in the form of forklift trucks: it is however to be appreciated that the invention has generally applicability, particularly but not exclusively to trucks, including earth moving trucks, dumper trucks and the like.

A problem frequently encountered by the manufacturers of forklift trucks is that, in an attempt to obtain maximum utilisation of the truck, drivers tend to operate the truck outside design parameters, in an attempt to accomplish prescribed tasks as quickly as possible. Such misuse of the truck causes premature failure of various operating components of the truck, to the detriment of the owners of the truck.

A frequently employed practice is to change gear at a time when this is not appropriate, in an attempt to use the momentum of the vehicle and/or the engine at the commencement of the performance of the forthcoming task. For example, an operator of a forklift truck may engage reverse gear whilst the vehicle is in forward motion, and attempt to use reverse gear engagement as an additional means of retarding the vehicle, and reducing the period of time taken for reverse movement of the vehicle to be commenced.

It is one of the various objects of this invention to provide a control system to prevent (as far as possible) the misuse of a vehicle by a driver operating the vehicle outside specific design parameters, and in particular to provide a system operative to prevent the driver engaging reverse gear whilst the vehicle is moving forwardly.

According to this invention there is provided a vehicle control system comprising:

(a) first sensing means for sensing engine speed;

(b) second sensing means for sensing vehicle speed;

(c) manually operative means movable between neutral, forward and reverse positions;

(d) gear change mechanism; and

(e) control mechanism operative to permit the gear change mechanism to effect a gear change operation in response to movement of the manually operative means under certain conditions but to prevent the gear change mechanism from effecting a gear change operation in response to certain other conditions.

Preferably the first sensing means is operative in the event that the engine speed moves to a predetermined speed to actuate an associated switch, and similarly, the second sensing means is operative in the event that the vehicle speed moves through a predetermined speed to actuate an associated switch.

Conveniently the second sensing means is operative to detect rotational speed of a vehicle wheel, or an associated drive element.

Desirable the control system comprises third and fourth sensing means, each operative in the event that the engine speed moves through a different predetermined speed, to actuate an associated switch.

Preferably the control system is effective in the event of movement of the manually operated means in the forward or reverse directions to prevent gear engagement in the event that the first sensing means senses an engine speed greater than a predetermined level.

Preferably the control mechanism is effective in the event of movement of the manually operated means directly between the forward and reverse positions to prevent a gear change from being effected if the vehicle speed and/or the engine speed are greater than a predetermined level, other than where the manually operated means is retained in an intermediate or neutral position for a sufficient length of time to allow the engine speed and/or the vehicle speed to reduce to below said predetermined level.

In this manner, by the selection of speed sensors effective to respond to a particular speed being reached, whether the engine speed or vehicle speed, control may be exercised over the driving of the vehicle in accordance with desired parameters. For example, by a selection of an appropriate sensing means, and by the manual setting of the sensing means so as to cause it to respond at said desired level, prior to installation as part of the vehicle control system, control may be exercised as to the range of the operating parameters.

There will now be given a detailed description, to be read with reference to the accompanying drawings, of a control system which is a preferred embodiment of this invention, and which has been selected for the purposes of illustrating the invention by way of example.

In the accompanying drawings:

FIGURE 1 is a schematic view of the preferred embodiment; and

FIGURE 2 is a circuit diagram of of the preferred embodiment.

The control system which is the preferred embodiment of this invention is specifically for use in conjunction with forklift trucks ("Hyster" trucks), although it is to be appreciated that the principles of the invention have wider applicability.

The control system, as is illustrated in the circuit drive diagram comprises the following elements:

(a) speed sensors SS1, SS2, SS3, and SS4 and associated switches. Of these, speed sensors SS1, 2 and 3 are operated from a magnetic pick-up from the differential gearing of the vehicle, and are arranged to operate (i.e. reverse the condition of an associated switch) at successively higher vehicle speeds. Thus switch SS1/1 is normally closed, and is adapted to be opened by the sensor SS1 when the vehicle is undergoing any motion; switch SS2/1 is normally open, and is arranged to close when the sensor SS2 detects that the vehicle is travelling at moderate speed; and switch SS3/1, similarly normally open, is arranged to close when sensor SS3 detects that the vehicle is travelling at a higher speed. Speed switch SS4/1 is similarly normally closed, and is adapted to be opened by sensor SS4 on receipt of a magnetic pick-up from a ring gear of the vehicle, which provides an output proportionally to the speed of the engine.

(b) magnetic relays RL1, RL2, RL3 and RL4, and associated relay latches RL1/1 and RL1/2, RL2/1, RL3/1 and RL3/2, and RL4/1 and RL4/2;

(c) a joystick, movable between reverse, neutral and forward positions (indicated R and F) and operative to open and close fixed switches S1, S3 and S4;

(d) a handbrake switch S2, which in the off position is closed, and an associated enable lamp E;

(e) solenoids to cause the transmission to select forward gear, reverse gear, and high/low gear ratios;.

With the vehicle idling, i.e. with the vehicle engine running at low speed (switch SS4/1 remaining closed) and under zero forward motion, relay RL2 is energised through line GHIJK, to close relay latch RL2/1. The joystick may be moved in the F direction, relay RL2 remaining energised. to open switch S1, and to close switch S3. When the handbrake is moved to its off position, S2 is closed, and relay RL3 is energised through line GJMQRS. closing relay RL3 and closing the associated relay latch RL3/1. As the accelerator is depressed. and the truck commences to move forwardly. the outputs to sensors SS1 and SS4 cause them to open switches SS1/1 and SS4/1., relay RL2 and RL3 nonetheless being retained energised through line PQRSM.

Energisation of relay RL3 also closes latch RL3/2. which causes the forward solenoid to engage forward gear.

At this stage. relay RL1 is deenergised. latch RL1/2 being open. and causing high gear to be selected (i.e. the vehicle travelling at low speed.)

As the vehicle speed increases, sensor SS2 causes switch SS2/1 to close): since relay RL1 is deenergised, latch RL1/1 is open, so there is no effect. On further increase in speed the output from the differential pick-up sensor SS3. causes switch SS3/1 to close, energising relay RL1 through the ABEF which closes latch RL1/1. and RL1/2. causing low gear to be selected.

Since latch RL1/1 is closed. high gear is not immediately reselected should the speed of the vehicle reduce, causing switch SS3/1 to open. since relay RL1 will be maintained energised through lines ACDEF.

If reverse is selected whilst the vehicle is stationary, the joystick is moved in the R direction to close switch S4. With the handbrake off and switch S2 closed, since relays RL2/1 and switches SS1/1 and SS4/1 are closed. relay RL4 is energised. closing latch RL4/2 to engage reverse gear. and simultaneously closing latch RL4/1 to maintain the engine in reverse.

In either event. if the engine is unduly revved whilst the jovstick is moved in the forward or reverse directions. switch SS4/1 will open. to prevent energisation of relay RL2, and engagement of gear. Simultaneously. if the vehicle is moving forwardly at any speed. switch SS1/1 will open. similarly preventing energisation of relay RL2.

If the joystick is in forward gear with S3 closed. and relay RL3/1 closed, power to relay RL3 is then derived through line HMQRS. If the driver attempts to select reverse directly, S3 opens to deenergise RL3. and closes switch S4. However relay RL4 is deenergised and latch RL4/1 is open. and relay RL3 i

However if the driver first engages neutral (medium position), and allows the engine speed and vehicle speed to drop, SS1/1 and SS4/1 close, and RL2 is energised through line GHIJK. In addition, when a hand brake is taken off, the enable lamp E is energised through line GHIMQRVW, indicating that the driver may engage reverse gear. By moving the joystick in the R direction, switch S4 is closed, energising relay RL4, closing latch RL4/1.

In particular, the above system prevents a driver, whilst moving forwards, from taking the joystick directly from the forward to the reverse position, momentarily breaking to cause the wheels to skid to deenergise speed switches SS1 and SS2, since, unless the joystick is retained for a short period in the neutral position, relay RL2 will remain unpowered.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, or a class or group of substances or compositions, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS:

1. A vehicle control system comprising:
(a) first sensing means for sensing engine speed;
(b) second sensing means for sensing vehicle speed;
(c) manually operative means movable between neutral. forward and reverse positions;
(d) gear change mechanism; and
(e) control mechanism operative to permit the gear change mechanism to effect a gear change operation in response to movement of the manually operative means under certain conditions but to prevent the gear change mechanism from effecting a gear change operation in response to certain other conditions.

2. A control system according to Claim 1 wherein the first sensing means is operative in the event that the engine speed moves through a predetermined speed to actuate an associated switch.

3. A control system according to any one of Claims 1 and 2 wherein the second sensing means is operative in the event that the vehicle speed moves through a predetermined speed to actuate an associated switch.

4. A control system according to any one of the preceding claims wherein the second sensing means is operative to detect rotational speed of a vehicle wheel. or an associated drive element.

5. A control system according to any one of the preceding claims comprising third sensing means operative in the event that the engine speed moves through a different predetermined speed to actuate an associated switch.

6. A control system according to Claim 5 comprising fourth sensing means operative in the event that the engine speed moves through a further predetermined speed to actuate an associated switch.

7. A control system according to any one of the preceding claims wherein the control mechanism is effective in the event of movement of the manually operated means in the forward or reverse directions to prevent gear engagement in the event that the first sensing means senses an engine speed greater than a predetermined level.

8. A control system according to any one of the preceding claims wherein said control mechanism is effective in the event of movement of the manually operated means directly between the forward and reverse positions to prevent a gear change from being effected if the vehicle speed and/or the engine speed are greater than a predetermined level.

9. A vehicle comprising a control system according to any one of the preceding claims.

10. The invention according to Claim 9 wherein the vehicle is a fork lift truck.

11. A vehicle control system constructed and arranged substantially as hereinbefore described with reference to the accompanying drawings.

12. Any novel feature or novel combination of features as hereinbefore described and/or as shown in the accompanying drawings.